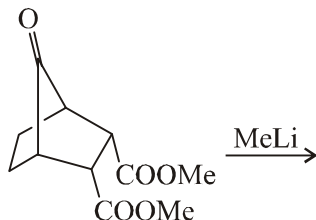


(4)

- (c) Predict the major product formed in the following reaction by using the Cieplak model. 2



- (d) MO energy levels pattern of the following two molecules are very similar – explain from HMO theory. 4

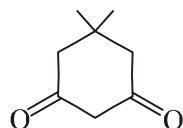
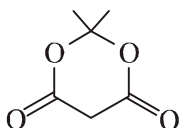


Cyclobutadiene
(square planar)



Trimethylenemethane

- (e) Which one of the following compounds is most acidic? Justify. 2



- (f) The photoelectron spectrum of CH₄ shows two bands for the valence shell – one at 23 eV and the other at 12.7 eV – explain. 2

★ ★ ★

Answer Q. No. 1 and any one from 2 and 3 :

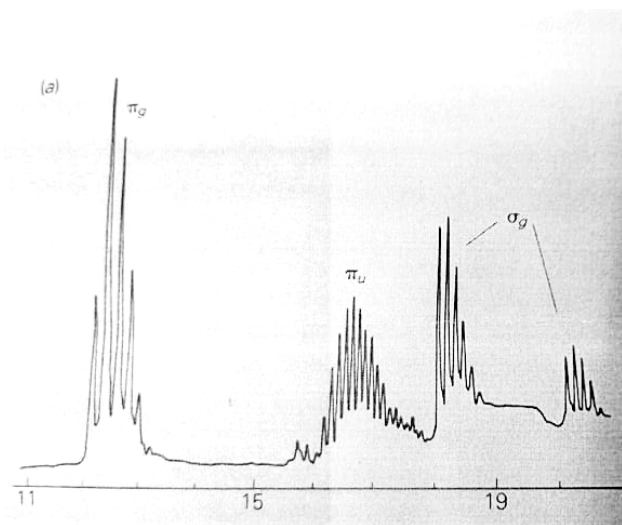
1. (a) Outline the underlying principle of Electron Probe Micro Analysis (EPMA). Mention the basic components of this typical microprobe. Name one detector of it. What is the specific advantage of this analytical technique? 2+1+1+1
- (b) “Chemical Ionization (CI) is complementary to Electron Ionization (EI)” — justify the statement. Outline some application areas of Laser Microprobe Mass Spectrometry (LAMMS). 1+2
- (c) Mention the mechanism of Fast Atom Bombardment (FAB) as employed in mass spectrometry. 2

(2)

(OR)

Describe Laser Desorption (LD) technique in the context of mass spectrometry. 2

2. (a) What is ESCA and what are its utilities? State the basic principles of ESCA. 2+1
- (b) Explain how X-ray photoelectron spectroscopic measurement can be used to understand the oxidation state of Mo in the complexes, $\text{Mo}(\text{CO})_4(\text{PPh}_3)_2$, $\text{MoCl}_2(\text{CO})_2(\text{PPh}_3)_2$ and $\text{MoCl}_4(\text{PPh}_3)_2$. 2
- (c) Given below is the UV photoelectron spectra of O_2 .



Taking help of MO diagram, explain the line-shape of each of the bands. Explain why loss of an electron from σ_g level gives rise to a pair of bands. 3+2

CHEM-1030

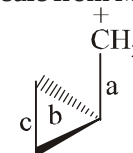
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(3)

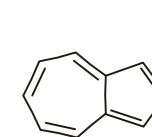
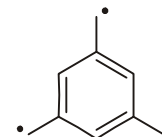
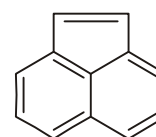
3. (a) Explain the photoelectron spectra of HCl. 2
- (b) What do you mean by XPS? Comment on the importance of XPS. 1+1
- (c) Explain the photoelectron spectra of CH_4 from its MO energy level diagram. 2
- (d) The 1s electrons of He have much less bonding energy than the 1s electrons of Li. Suggest the appropriate reason for this. 2
- (e) Discuss the characteristics of the photo-electron spectrum of O_2 . 2

UNIT—310-O-2

4. (a) Draw the Walsh-Molecular Orbitals of cyclopropane. Why is the ^1H -NMR chemical shift (δ) of cyclopropane (0.22 ppm) lower in comparison to cyclobutane (1.98 ppm)? Compare the 'a', 'b' and 'c' bond lengths of the following molecule from MO standpoint. 3+2+1



- (b) Designate the alternant and nonalternant hydrocarbons of the following molecules. Calculate the nonbonding MO (Ψ_4) lobe coefficients for benzyl cation. 2+2



CHEM-1030

[Turn Over]